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(71)(72) Applicant and Inventor: PESONEN, Leo [FI/FI]; Pallokuja 2 as 12, FIN-01280 Vantaa (FI).

(74) Agents: LAINE, Seppo et al.; Seppo Laine Oy, Lönnrotinkatu 19 A, FIN-00120 Helsinki (FI).

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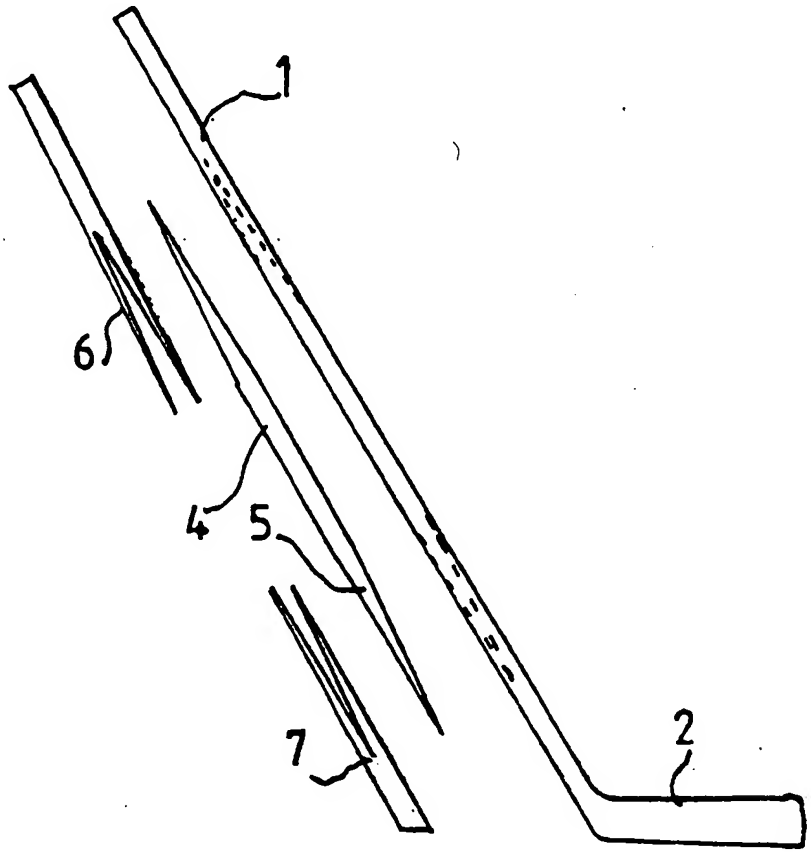
(54) Title: ICE-HOCKEY STICK

(57) Abstract

In this document is described an ice-hokey stick comprising an essentially straight stick shaft (1) and a blade (2) attached to the lower end of the shaft and sideways aligned to an angle relative to the shaft. According to the invention the stick includes at least one oblong reinforcement part (4, 5) extending from the center toward each stick shaft end, with a cross section diminishing toward the ends of the stick shaft (1), whereby the stiffness of stick shaft (1) is variable in the longitudinal direction of the stick shaft so that the stiffest area of the stick shaft (1) is approximately at the midpoint of the shaft (1), that is, the lower hand grip point of the player using the stick, and the shaft stiffness diminishes from the grip point toward the ends of the stick shaft.



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Ice-hockey stick

The present invention is related to an ice hockey stick according to the preamble of the claim 1.

Several different methods of striking the puck are used in the game of ice-hockey. The highest speed for the puck is attained by a slap shot in which the player's lower hand holding the stick at its lower part and stick are rotated at the side of the player's body behind the body, and the puck is then shot vigorously forward by rotating the body and simultaneously sending the lower hand with the stick energetically forward. In this manner the puck is accelerated by the stick blade at an extremely high speed in a successful shot, and the puck is provided with a maximum speed, thereby giving the goalkeeper a minimum time to react to the approaching puck.

The flexibility of the stick shaft is extremely important for attaining a powerful shot. When the stick blade hits the puck, the blade is bent backward and the stick shaft is flexed forward at the player's lower hand. As the shafts of conventional sticks have a constant cross section over the entire length of the stick shaft, and consequently, a constant stiffness, the stick is obviously flexed maximally at the player's lower hand which pushes the stick forward. However, such a function of the stick fails to impart maximum energy to the shot. As the maximum deflection of the stick shaft occurs at the midpoint of the shaft, the ends of the stick shaft remain almost unbent, whereby the elasticity of the whole stick shaft length remains marginally utilized in the shot. Thus, a portion of the shot input energy is consumed in bending the shaft and thus will not contribute to the puck speed as it leaves the stick blade.

It is an object of the present invention to achieve an ice-hockey stick suited to impart a maximum acceleration to the puck in a slap shot through improved utilization of the elasticity of the stick shaft.

The invention is based on designing the stick shaft stiffness to be nonconstant so that the highest stiffness of the shaft coincides at least essentially with the lower hand of the player using the stick and then fall off toward the lower shaft end or both shaft ends.

More specifically, the ice-hockey stick according to the invention is characterized by what is stated in the characterizing part of the claim 1.

The invention offers significant benefits.

By virtue of the present invention, the energy imparted by the player to the shot is utilized to a greater degree than in the prior art. In fact, the stick shaft can be made almost inflexible at the grip of the player's lower hand, whereby the stick ends obviously bend more than in the prior art, and the stick shaft acts as a bow. However, in practice the stick shaft is stiffened only so much that the deflection of the stick shaft is as constant as possible over the entire length of the shaft. When the puck leaves the blade, the spring-like shaft effectively converts the energy used for bowing the shaft into the translational energy of the puck, thus imparting maximum possible initial speed for the puck. The flexible part of the stick shaft becomes longer owing to the more homogeneous distribution of the shaft deflection over its entire length, whereby its total permissible deflection becomes larger. Though the shaft is designed for a nonconstant stiffness, its fabrication cost will not be appreciably higher than that of a conventional stick. The external dimensions and outlook of the stick can be kept identical to that of the prior-art sticks, thus obviating the need for the players to spend time for getting accustomed with the novel stick shaft, whereby the acceptance threshold for the novel stick will be low.

In the following the invention will be examined in more detail with reference to the attached drawing, in which:

Figure 1 is a side view of an embodiment of the ice-hockey stick according to the invention shown with the stick reinforcements;

Figure 2 is a view of the stick illustrated in Fig. 1 shown from the direction of the stick blade;

Figure 3 is a cross section of the stick shaft; and

Figure 4 is an assembly diagram for the different elements of the stick shaft according to the invention.

The stick shaft can be fabricated starting from a core 3 of the stick made by, e.g., gluing from wood or plywood, and then applying the reinforcement plies onto the core by gluing. A suitable thickness for the core is approx. 17 mm, since the target thickness for a finished shaft is 20 mm with a rectangular cross section of approx. 20 mm by 30 mm. Onto the shaft blank thus fabricated is next laminated by gluing a reinforcement part 4, 5 comprising a center part as wide as the shaft 1 and wing parts linearly tapering from the center part. The length of the center part 4 is 200 – 300 mm, and the wing parts 5 are designed so tapering that their total length from the end of the center part to the tip of the wing-part is 200 – 300 mm. The reinforcement is glued onto the shaft blank 1 so that its center 4 is coincident with the grip position of the player's lower hand. In practice the center of a reinforcement in a stick of 1400 mm length is placed to approx. 700 mm from the heel joint between the blade 2 and the shaft 1. The location of the reinforcement center point may, and in fact, should be aligned exactly to the normal grip point of each individual player. After the gluing step of the reinforcement 4, 5, complementary pieces 6, 7 with a thickness identical to that of the reinforcements are laminated to the stick shaft ends, whereby the complementary pieces must be designed to have a forked end complementary to the shape of the tip 5 of the reinforcements 4, 5. Now the shaft 1 is brought to a

constant thickness permitting an optional, conventional reinforcement ply and a top ply 8 to be glued onto it.

The thickness of the reinforcement is approx. 0.5 - 1 mm and the reinforcement is applied at least to the front side of the shaft 1, that is, on that side of the stick where the blade 2 is concave. If a stiffer shaft 1 is desirable, the reinforcement can be applied to both sides of the shaft 1. The material of the reinforcement part 4, 5 can be, e.g., glass fiber or carbon fiber or any other reinforcement material offering sufficient stiffness properties. The complementary pieces 6, 7 to the reinforcement are advantageously of the same material as the stick shaft, whilst their material selection is nonessential to the function of the shaft 1.

With reference to the embodiments illustrated in Figs. 1 - 4, the reinforcement 4, 5 is shuttle-shaped in the side view, and its both wing parts 5 are triangularly tapered to sharp tips. The shape of the wing parts and thus the entire shape of reinforcements can be varied in a wide range. However, it is essential to provide a sufficiently monotonous stiffness change along the length of the stick shaft to avoid the occurrence of an abrupt stiffness discontinuity at which the shaft might break under load. The tips of the reinforcements can alternatively be forked, for example, whereby the tips of the reinforcements and their complementary pieces will have mirrored shapes to those shown in the diagrams. The gradual change of the stick cross section may also be realized advantageously so that, e.g., the thickness of the reinforcement gradually tapers off toward the ends of the stick shaft, whereby the reinforcement can have a constant width over its entire length. Obviously, the shape design of the reinforcement can be implemented in a plurality of manners, and a separate reinforcement piece is not necessarily needed in all embodiments of the invention. Sticks with composite material or aluminum shafts which are emerging on the market can be easily fabricated to have a variable stiffness in accordance with the invention. In practice this can be implemented through, e.g., varying the thickness of the shaft tube wall or the reinforcement structure of a composite material stick. In these cases the reinforcement part is an

integral part of the shaft material and no separate reinforcement part can be indicated. Manufacture of metal tubes having a constant external diameter and a varying inner diameter is known per se and these kind of tubes are used for example in bicycle frames. A composite structure offers a wide variety of possibilities. Properties of a composite structure can be varied by changing the amount or material of reinforcement fibres. In a composite structure dimensions of the structure do not alone characterise the properties of the structure and for example, the flexibility of a composite shaft depends mainly of the volume and properties of the reinforcement material in a given cross section. Advantageously, the external cross-sectional dimensions of the stick shaft are maintained constant over the entire length of the stick shaft, whilst in special cases also a stick with the thicker cross section at the player's grip point is feasible. However, since a variable stick shaft thickness may feel odd to the players, a stick with a constant cross section must be preferred.

When a conventional reinforcement system of an ice-hockey stick is combined with the embodiment according to the invention, an extremely wide range of stick shaft characteristics in a shot situation can be realized. For the maximum control of the initial energy of the shot it is most advantageous to have a relatively stiff stick shaft which is nonflexible exactly at the grip point of the player's lower hand with a gradually increasing flexibility toward the stick ends. This kind of a stick design makes the stick behave ideally and offers the highest efficiency in converting the energy imparted by the player into the translational energy of the puck. Top players use today custom-made sticks, and by virtue of this invention, a flexible stick compliant with the minutes of the player's preferences can be fabricated in an uncomplicated manner. The flexibility of the stick can be made to vary, e.g., progressively or to be asymmetric relative to the grip point. For example, the flexibility of the shaft can be constant above the grip point and decrease from the grip point towards the blade.

Claims:

1. An ice-hockey stick comprising an essentially straight stick shaft (1) and a blade (2) adapted to the lower end of the shaft and sideways aligned to an angle relative to said stick, c h a r a c t e r i z e d in that said shaft stick (1) includes at least one oblong reinforcement part (4, 5) extending from the center toward each stick shaft end, with a cross section diminishing toward at least the lower end of the stick shaft (1), whereby the stiffness of stick shaft (1) is variable in the longitudinal direction of the stick shaft so that the stiffest area of the stick shaft (1) is situated approximately at the midpoint of the shaft (1), that is, the lower hand grip point of the player using the stick, and the shaft stiffness diminishes from the grip point toward the end of the stick shaft.

2. An ice-hockey stick according to claim 1, c h a r a c t e r i z e d in that the reinforcement part (4, 5) diminishes towards both ends of the shaft (1).

3. An ice-hockey stick according to claim 1 or 2, c h a r a c t e r i z e d in that the shaft (1) is a metal tube having a constant outer diameter and a variable inner diameter.

4. An ice-hockey stick according to claim 1 or 2, c h a r a c t e r i z e d in that the shaft (1) is a composite structure wherein the flexibility of the shaft is varied by changing the reinforcement structure within the shaft (1).

5. An ice-hockey stick according to claim 1, 2, or 4, c h a r a c t e r i z e d in that the shaft (1) has a variable outer diameter.

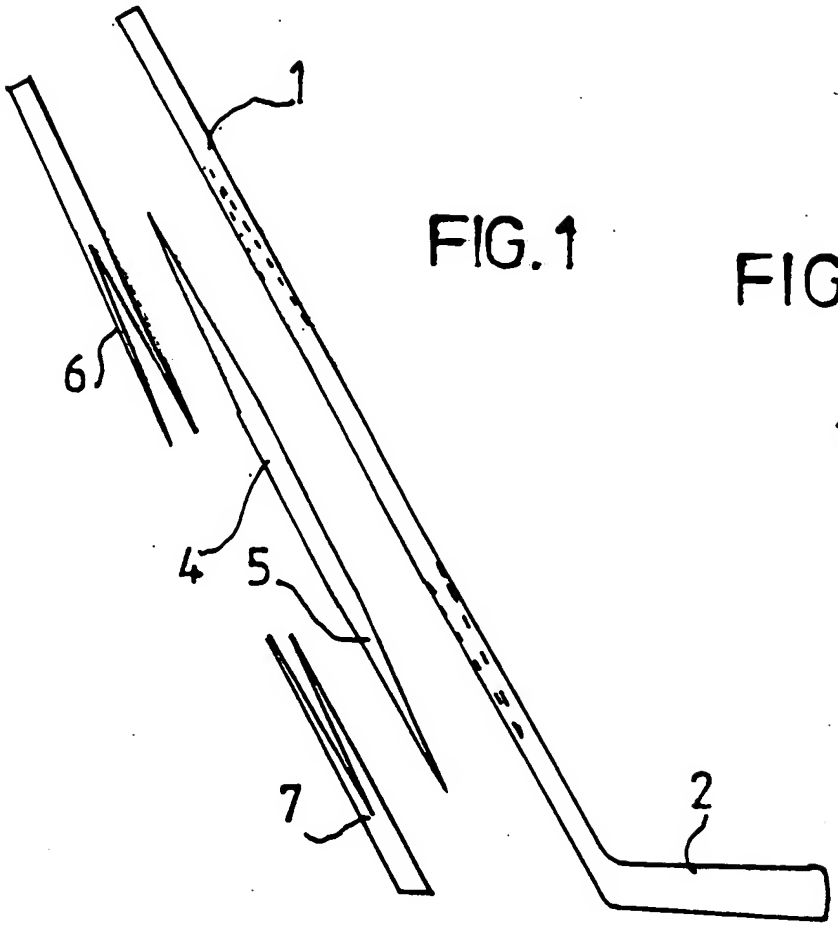

FIG. 1

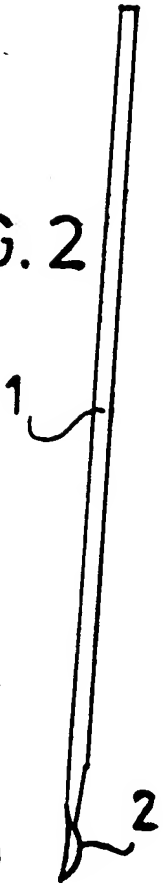

FIG. 2

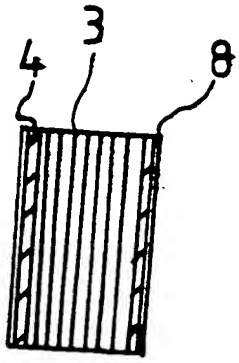

FIG. 3

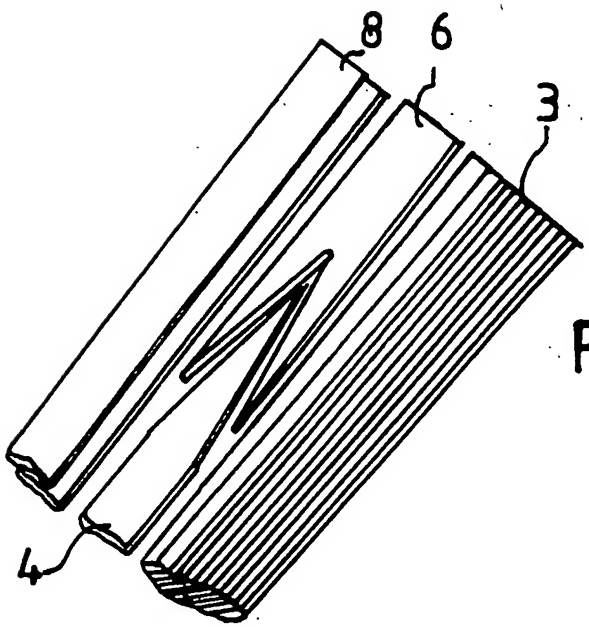

FIG. 4

International application No.
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B. FIELDS SEARCHED

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IPC 6: A63B

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE, A1, 3344781 (EXEL OY), 20 June 1984 (20.06.84), page 7, line 12 - page 8, line 6 --	1,4
A	US, A, 3489412 (D.R. FRANCK ET AL), 13 January 1970 (13.01.70), column 1, line 31 - column 2, line 61, figures 2,3a-3c --	1,3,5
A	SE, C, 169928 (L.W.G. MALMBERG), 22 December 1959 (22.12.59), the whole document --	1

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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